

## CLAIMS

We Claim:

1. An expanded olefin resin comprising:  
a copolymer base resin and a blowing agent,  
the copolymer base resin comprising about 99.95 to 99.999 weight percent of an olefin and about 0.001 to 0.05 weight percent of an  $\alpha$ - $\omega$  diene, wherein the copolymer base resin has a weight average molecular weight of about 30,000 to 500,000 Daltons, a crystallization temperature of about 115°C to 135°C, and a melt flow rate of about 0.1 dg/min to 100 dg/min as determined using ASTM D-1238 at 230°C and 2.16 kg load.
2. The expanded olefin resin of claim 1, wherein the  $\alpha$ - $\omega$  diene includes 1,6-heptadiene, 1,7-octadiene, 1,8-nonadiene, 1,9-decadiene, 1,10-undecadiene, 1,11-dodecadiene, 1,12-tridecadiene, 1,13-tetradecadiene, 2-methyl-1,9-decadiene, 2-methyl-1,7-octadiene, 3,4-dimethyl-1,6-heptadiene, 4-ethyl-1,7-octadiene, 3-ethyl-4-methyl-5-propyl-1,10-undecadiene, or a combination comprising at least one of the foregoing dienes.
3. The expanded olefin resin of claim 1, wherein the copolymer base resin comprises ethylene, propylene, butene-1, pentene-1, hexene-1, heptene-1, 4-methyl-1-pentene, 3-methyl-1-pentene, 4-methyl-1-hexene, 5-methyl-1-hexene, 1-octene, 1-decene, 1-undecene, 1-dodecene, or a combination comprising at least one of the foregoing.
4. The expanded olefin resin of claim 1, wherein the copolymer base resin comprises a metallocene-based copolymerization reaction product comprising propylene and one or more  $\alpha$ - $\omega$  diene monomers.

5. The expanded olefin resin of claim 1, wherein a ratio of the weight average molecular weight to the number average molecular weight of the copolymer base resin is about 2 to about 20.
6. The expanded olefin resin of claim 1, wherein a ratio of the weight average molecular weight to the number average molecular weight of the copolymer base resin is about 2.5 to about 7.
7. The expanded olefin resin of claim 1, wherein the copolymer base resin has a melting point of less than or equal to about 165°C.
8. The expanded olefin resin of claim 1, wherein the copolymer base resin has a ratio of extensional viscosity at break to linear viscosity of greater than or equal to about 2.5 at a strain rate from about 0.1 second<sup>-1</sup> to about 1.0 second<sup>-1</sup>.
9. The expanded olefin resin of claim 1, which is capable of being foamed into an article to produce a foamed resin article having a bulk density of about 0.001 g/ml to about 0.8 g/ml.
10. The expanded olefin resin of claim 1, wherein the copolymer base resin has a branching index  $g''$  of about 0.99 to about 0.6, as determined from the equation:

$$g'' = [\text{IV}]_{\text{branched}} / [\text{IV}]_{\text{linear}}$$

wherein IV is the intrinsic viscosity of the branched and linear polymers, respectively.

11. The expanded olefin resin of claim 10, wherein the branching index  $g''$  is about 0.99 to about 0.93.

12. The expanded olefin resin of claim 1, wherein the blowing agent comprises an organic acid, an inorganic acid, a salt of a carbonic acid, or a combination comprising at least one of the foregoing.
13. The expanded olefin resin of claim 12, wherein the organic acid comprises citric acid, and wherein the salt of carbonic acid comprises sodium carbonate, sodium bicarbonate, ammonium carbonate, ammonium bicarbonate, potassium carbonate, potassium bicarbonate, or a combination comprising at least one of the foregoing.
14. The expanded olefin resin of claim 1, wherein the blowing agent comprises methane, ethane, ethylene, propylene, ethyn, propyne, butane, pentane, hexane, heptane, trichlorofluoromethane, dichlorodifluoromethane, tetrachloroethane, dichlorotetrafluoroethane, methylene chloride, ethyl chloride, nitrogen, oxygen, air, helium, argon, carbon dioxide, water, or a combination comprising at least one of the foregoing.
15. An expanded olefin resin particle comprising the expanded olefin resin of claim 1.
16. A process to produce an expanded olefin resin, comprising:  
contacting a copolymer base resin with a blowing agent under a pressure greater than or equal to atmospheric pressure,  
heating the copolymer base resin and the blowing agent to a temperature greater than or equal to the softening point of the olefin copolymer base resin,  
to produce an expanded olefin resin,  
wherein copolymer base resin comprises about 99.95 to 99.999 weight percent of an olefin, and about 0.001 to 0.05 weight percent of an  $\alpha$ - $\omega$  diene, and

wherein the copolymer base resin has a weight average molecular weight of about 30,000 to 500,000 Daltons, a crystallization temperature in a range from 115°C to 135°C, and a melt flow rate in a range from 0.1 dg/min to 100 dg/min as determined using ASTM D-1238 at 230°C and 2.16 kg load.

17. A foamed article comprising a foamed expanded olefin resin, wherein prior to foaming, the expanded olefin resin comprises a copolymer base resin and a blowing agent, wherein the copolymer base resin comprises about 99.95 to 99.999 weight percent of an olefin and about 0.001 to 0.05 wt% of an  $\alpha$ - $\omega$  diene, wherein the copolymer base resin has a weight average molecular weight of about 30,000 to 500,000 Daltons, a crystallization temperature in a range from 115°C to 135°C, and a melt flow rate in a range from 0.1 dg/min to 100 dg/min, as determined using ASTM D-1238 at 230°C and 2.16 kg load, and wherein the foamed article has a bulk density of about 0.001 g/ml to about 0.8g/ml.
18. A process to produce the foamed article comprising a foamed expanded olefin resin of claim 17, the process comprising:  
heating the expanded olefin resin,  
reducing the pressure being applied to the expanded olefin resin, or both,  
to produce an expanded foamed article.